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A new calanoid copepod species from South Carolina, U.S.A.: *Aglaodiaptomus savagei* (Crustacea: Copepoda: Calanoida: Diaptomidae)

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Abstract.—*Aglaodiaptomus savagei,* new species, was collected from a seasonal wetland pond in Kershaw County, South Carolina, U.S.A. Additional populations were found in eastern North Carolina, U.S.A. The female most closely resembles *A. forbesi* Light, 1938, and *A. lintoni* Forbes, 1893, but they are separated by the armament of the antennule, body length, and geographic range. Male *A. savagei* can be confused with male *A. spatulocrenatus* Pearse, 1906. Differences occur mainly in the ornamentation of the fifth leg, as well as segment sizes in the fifth leg.

A new species of calanoid copepod was collected during a survey of wetland ponds on the coastal plain of South Carolina, U.S.A. It is the second new species of this genus to be described from southeastern North America since Wilson's (1959) key to the North American calanoids was published. A total of 15 *Aglaodiaptomus* species are known from North America. The new species was first collected only about 140 km from the type locality of another recently described congener, *A. atomicus* DeBiase & Taylor, 1997, which also occurs in wetland ponds. The new species is the third new diaptomid to be recognized from this region since 1959, along with *Skistodiaptomus carolinensis* Yeatman, 1976.

The copepods were fixed and stored in 4% formalin with sucrose (600 g/l), and paratypes were transferred to ethanol. Measurements were made in glycerine, using Image Pro Plus® (Nashville, Tennessee, U.S.A.) image analysis software. Descriptions of whole specimens were made from individuals mounted in glycerine jelly. Individuals were straightened and positioned in melted jelly and held in place until it solidified. Dissected specimens were mounted in CMC-9®. The specimens were studied using diffusion interference contrast (Nomarski) microscopy, thus they were not stained.

The new species was compared to specimens of *A. spatulocrenatus* Pearse, 1906 to verify that it is indeed a separate species. The *A. spatulocrenatus* specimens were collected from the following locations: Pond near outlet of John Pond, Mashpee, Massachusetts, U.S.A. (USNM 60392); Lily Pond south of Ashmet Pond, Falmouth, Massachusetts (USNM 60388); Clements Pond, Hopkinton, New Hampshire, U.S.A.; Adams Pond, Barnstead and Pittsfield, New Hampshire, and Hall, Upper Pond, Sandwich, New Hampshire (all USNM 210801), M. S. Wilson, collector.

Family Diaptomidae Baird 1850
Genus *Aglaodiaptomus* Light, 1939
Aglaodiaptomus savagei, new species
Figs. 1–3

Type material.—Holotype ♂, USNM 296406; allotype ♀, USNM296407; 12 ♂♂ 6 ♀♀, each dissected on slide in CMC-9,

and 25 ♂♂ 25 ♀♀ + copepodids, undissected and preserved in ethanol; all from Savage Bay, Kershaw County, South Carolina, 34°07′49″N, 80°31′27″W, 7 Aug 1996, B. E. Taylor, collector.

Additional non-type material.—5 ♂♂ 5 ♀♀, dissected and mounted on slides in glycerine, and 30 ♂♂ 30 ♀♀, undissected and preserved in ethanol, USNM 296408, North Carolina, Onslow County, Site 14, 34°37′03″N, 77°18′49″E, United States Marine Corps Camp Lejeune, directly adjacent to unnamed dirt road on northwest side, 210 m southwest of Well Point Road, dirt road intersects Well Point Road 330 m northeast of Well Camp Road. Also 20 ♂♂ 20 ♀♀ dissected on slides in CMC-9, and 200 ♂♂ 200 ♀♀ + copepodids, undissected in formalin, from 9 additional ponds (all located in United States Marine Corps Camp Lejeune, 34°37′03–34°37′59′N, 77°18′49″–77°19′30″E). All collected 4 Feb 2000 by J. C. Mitchell.

Co-occurring Diaptomidae.—None observed in type location or Camp Lejeune Site 14; *Onychodiaptomus birgei* Marsh, 1894 or *Skistodiaptomus reighardi* Marsh, 1895 in 8 Camp Lejeune Sites, *S. reighardi* and *O. birgei* in remaining Camp Lejeune Site.

Male.—Length, excluding caudal setae: 1.0–1.3 mm (n = 20, $\bar{X}$ = 1.25 mm). Body broadest at pedigers 1 and 2 in dorsal view (Fig. 1A). Pedigers 4 and 5 weakly fused. Thoracic wings nearly symmetrical, with small dorsomedial and ventrolateral sensilla (Fig. 1B). Urosome of 5 segments and caudal rami (Fig. 1B); segment 1 asymmetrical; left posterior distal corner with medium-sized lobe, right posterior distal corner without lobe (Fig. 1C). Both corners tipped with small sensillum. Segments 2–4 symmetrical. Inner margins of caudal rami lined with fine setules.

Antennules reaching distal margin of urosomite 4 (Fig. 1A).

Left antennule 25-segmented (as in Fig. 3B); armature per segment as follows (s = number of setae, a = aesthetasc, sp = spine): 1(s+a), 2(3s+a), 3(s+a), 4(s), 5(s+a), 6(s), 7(s+a), 8(s+sp), 9(2s+a), 10(s), 11(2s), 12(s+sp+a), 13(s), 14(s+a), 15(s), 16(s+a), 17(s), 18(s), 19(s+a), 20(s), 21(s), 22(2s), 23(2s), 24(2s), 25(5s+a). Setae on segments 17, 19, 20, 22 with stiffly hooked ends.

Right antennule segments 18–19, 20–21, and 22–23 fused; geniculation between segments 19 and 20 (Fig. 1E, F). Segments 10 and 11 each with spine reaching distal margin of succeeding segment; spine on segment 10 distolaterally directed, spine on segment 11 distally directed (Fig. 1D). Distolaterally directed spine on segment 13 about as long as segment 14. Distal spines on segments 14–17 bifurcated at tips. Modified digitiform seta (Fig. 1E) borne on proximal ¼ of segment 17, extending to midlength of fused segment 18–19 (a). Additional digitiform setae arising near distal margin of segment 18–19, extending to distal margin of segment (b), and from proximal ¼ of segment 20–21, almost reaching distal margin of bearing segment (c). Curved distal process (Fig. 1F) on segment 22–23 about ½ the length of segment 24.

The segmentation and armature of the mouthparts and swimming legs are the same as those of another congener, *Diaptomus* (*Aglaodiaptomus*) *kingsburyi* Robertson, 1975. Leg 2 endopod 2 with well-developed Schmeil's organ on posterior surface (Fig. 2A). Left leg 5 (Fig. 2B–F): Leg (excluding spines) extending to distal margin of right leg exopod 1. Coxa with distolateral lobe tipped with sensillum. Basis with slender, minute lateral seta inserted at ⅓ segment length from distal margin. Exopod 1 twice as long as exopod 2; hairy pad on distolateral corner (Figs. 2C, D). Exopod 2, distal ⅓ of posterior surface covered with minute protuberances (Fig. 2C); protuberances covering about 1/10 of anterior surface of distal end (Fig. 2D). Inner margin lined with fine hair-like setules. Processes on exopod 2 subterminal. Inner process with a wide base, slightly shorter than exopod 2; inner margin of process lined

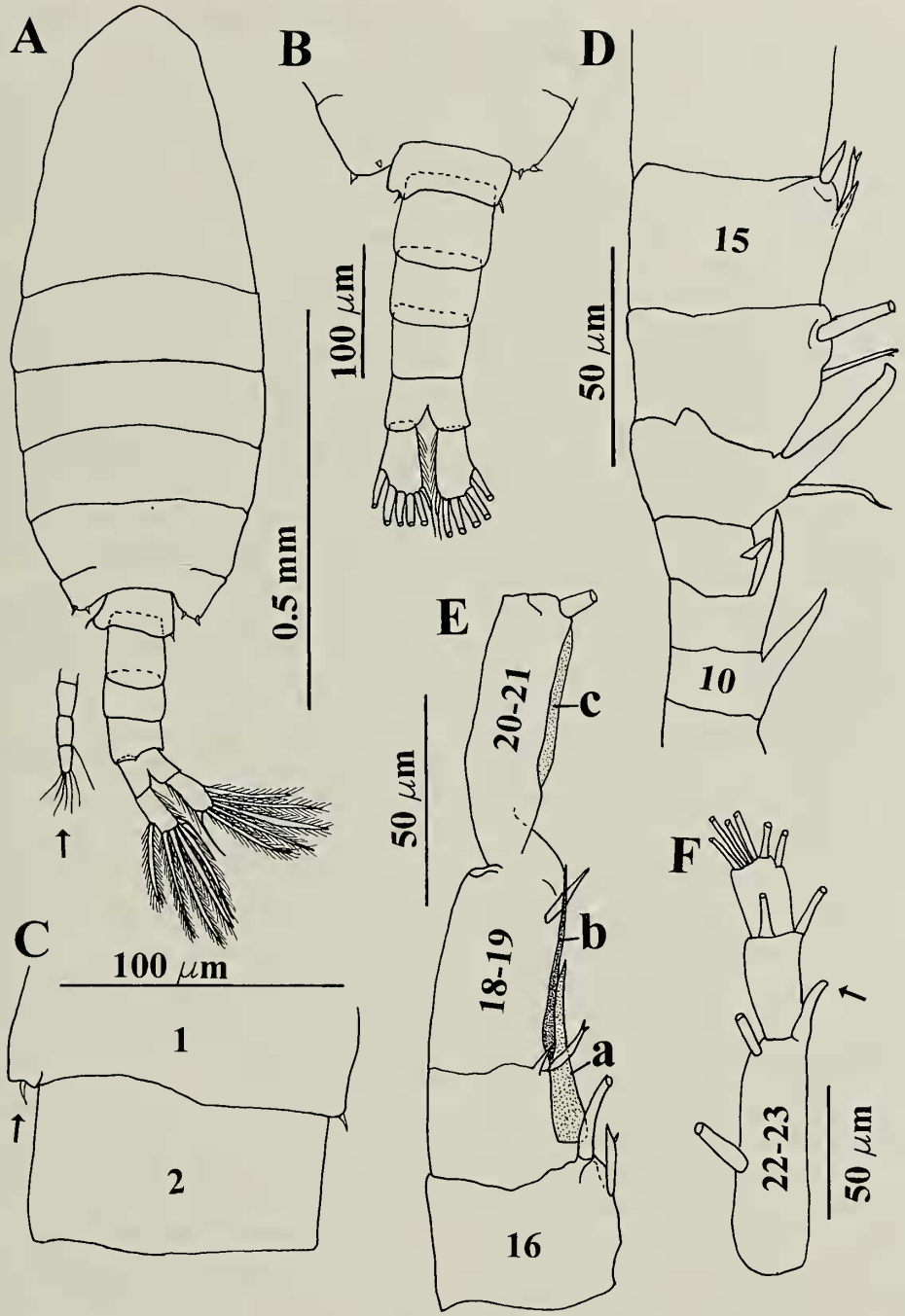

Fig. 1. *Aglaodiaptomus savagei*, new species, male: A, Habitus, dorsal; B, Urosome, dorsal; C, Urosome, segments 1–2, bilobed process indicated by arrow; D, Right antennule, segments 10–15; E, Right antennule, segments 16–21, modified digitiform setae indicated by stippling and labeled "a", "b", "c"; F, Right antennule, segments 22–25, lateral spine indicated by arrow.

with fine setules. Outer process shorter than inner process; distal end rounded and smooth. Endopod, excluding terminal processes (Figs. 2B, E, F), longer than exopod; outer margin with scale-like protrusions in both dorsal and ventral views. Margins of "scales" lined with fine spinules. Inner tip of endopod with pad of fine denticles in posterior view (Fig. 2E).

Right leg 5 (Fig. 2B, G, H): Coxa with distomedial lobe tipped with sensillum (Fig. 2B). Basis with lobed protrusion on medial-posterior face, proximal ½ of segment (Fig. 2G); seta emerging from distal ⅓ of lateral margin. Endopod greatly reduced, represented by laterally bent lobe, distal ½ of lobe covered with fine setae. Exopod 1 about ¾ as long as basis; short with wide bilobed process on distolateral corner (Fig. 2H). Exopod 2 about twice as long as exopod 1. Terminal claw of exopod 1 robust and wide-based; claw equal in length to exopod 2. Inner surface of distal ½ of claw lined with fine denticles. Lateral spine curved, inserted at $^4/_5$ length of exopod 2; spine ⅔ as long as segment, inner surface of distal ⅓ lined with fine denticles.

Female.—Length, excluding caudal setae: 1.4–1.7 mm (n = 20, $\bar{X}$ = 1.51 mm). Prosome segmentation as in male (Fig. 3A). Antennules 25-segmented, reaching slightly beyond genital segment (Fig. 3A); armature as in male left antennule (Fig. 3B). Thoracic wings nearly symmetrical (Fig. 3C); left inner lobe more dorsally directed than right one. Lobe on each side tipped with small sensillum of approximately equal size. Urosome of 3 segments and caudal rami. Left and right margins of genital segment equal in length, each margin slightly protuberant. Lateral protuberances each tipped with small spine; left lobe and spine placed slightly more proximal than right. Genital operculum with broad proximal plate; distal plate of intermediate width with short arms; transverse plate narrow and crescentic (Fig. 3D). Caudal rami about twice as long as broad; inner margins with fine setules (Fig. 3C).

Mouthparts and swimming legs: As in male.

Leg 5 (Fig. 3E): Coxa with posterior lateral protrusion tipped with sensillum. Basis with slender lateral seta. Exopod 1 slightly shorter than exopod 2 (including claw). Claw on exopod 2 relatively short, slightly curved, with fine denticles on inner and outer margins. No articulation between exopod segments 2 and 3. Lateral spine of exopod 2 about ⅔ length of outer seta of exopod 3. Inner seta of exopod 3 plumose, outer seta ⅔ as long as inner seta. Endopod reaching beyond distal margin of exopod 1; tipped with small, rounded, setule-covered protrusion and two setae covered with long, fine setules; setae equal in length and breadth, one terminal, one subterminal (Fig. 3F).

Color.—Pale blue; distal ⅓ of antennae orange-red. Blue pigmentation is lost with preservation. The red pigment may be lost or become purple-red.

Type locality.—Savage Bay, 34°07′49″N, 80°31′27″W, Savage Bay Heritage Trust Preserve, Kershaw County, South Carolina, U.S.A.

Etymology.—The species name is given after Savage Bay, its type location, and in honor of Henry Savage, Jr. (1903–1990), for whom the location was named. Mr. Savage was a noted naturalist, lawyer, and civic leader in South Carolina, as well as the author of the treatise "The Mysterious Carolina Bays" (1982).

Distribution and ecology.—*Aglaodiaptomus savagei* is presently known from one Carolina bay in north-central South Carolina and from nine ponds on the southeastern coast of North Carolina, U.S.A.

The type locality of *A. savagei* is a pair of adjacent Carolina bays in the Savage Bay Heritage Trust Preserve. The two basins combined have an area of 8 ha. Carolina bays are shallow, elliptical depressions with a northwest-southeast orientation (Taylor et al. 1999). They occur throughout the sandy Atlantic Coastal Plain from New Jersey to northern Florida, but are most common in

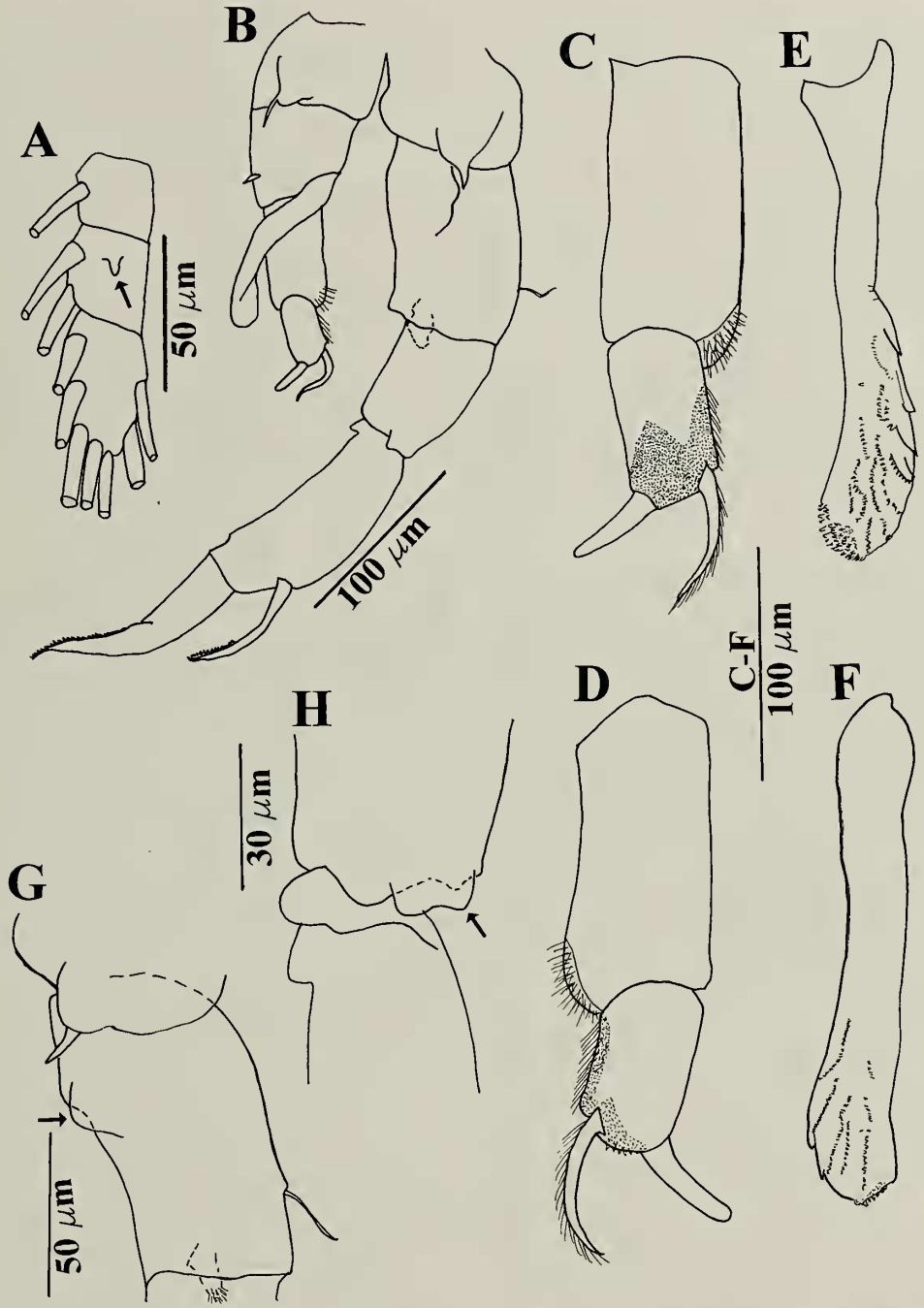

Fig. 2. *Aglaodiaptomus savagei*, new species, male: A, Leg 2 endopod, posterior, arrow indicating Schmeil's organ; B, Leg 5, posterior; C, Left leg 5 exopod 1 and 2, posterior; D, Left leg 5 exopod 1 and 2, anterior; E, Left leg 5 endopod, posterior; F, Left leg 5 endopod, anterior; G, Right leg 5 basis, medial, arrow indicating medial-posterior protuberance; H, Right leg 5, distal end of exopod 1, posterior, arrow indicating bilobed protuberance.

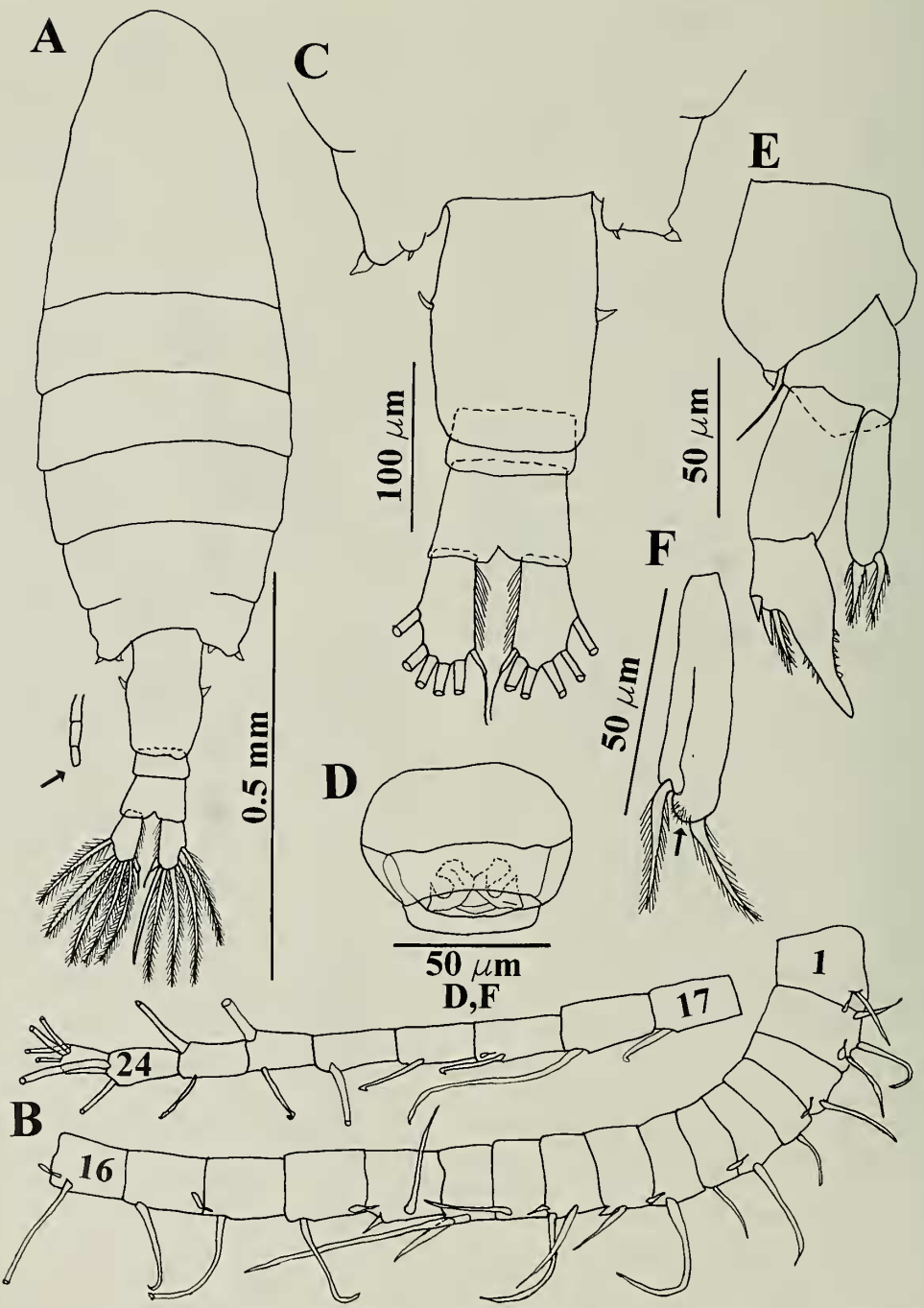

Fig. 3. *Aglaodiaptomus savagei*, new species, female: A, Habitus, dorsal, distal segments of antennule indicated by arrow; B, Antennule, dorsal; C, Thoracic wings and genital compound segment; D, Genital operculum; E, Leg 5, anterior; F, Leg 5 endopod, posterior, arrow indicating hairy lobed process on distal end.

Table 1.—Comparison of female *Aglaodiaptomus savagei* to *A. forbesi* and *A. lintoni*.

	A. savagei	*A. forbesi*	*A. lintoni*
Thoracic wings	Symmetrical	Symmetrical	Symmetrical
Genital segment	Slightly elongated, symmetrical	Short, symmetrical	Short, symmetrical
Antennules, segments 13–19[a]	One seta on each segment	Two setae on segment 16, one seta on each of segments 13–15, 17–19	Two setae on segment 16, one seta on each of segments 13–15, 17–19
Antennule length	Slightly beyond distal end of genital segment	Proximal end of caudal rami	Slightly beyond proximal end of caudal rami
Leg 5, endopod	Longer than exopod 1 by ⅕ to ¼ its length	As long as exopod 1	Longer than exopod 1 by ⅕ to ¼ its length
Length	1.3–1.7 mm	1.3–1.9 mm	1.7–2.5 mm
Geographic range	Eastern North and South Carolina	Pacific coast states, western Canada east to Saskatchewan	Rocky Mountains, Montana to Colorado

[a] Also male left antennule.

the Carolinas. Many of these wetlands fill and dry seasonally, and the waters are very acidic. On three dates from February–June 1994, the pH of Savage Bay ranged from 3.80–3.86. We have observed this wetland to dry periodically.

The vegetation of Savage Bay is dominated by pond cypress (*Taxodium ascendens* Brongniart, 1883) with an understory of myrtle-leaf holly (*Ilex myrtifolia* Walter, 1788) and the rare pond spice (*Litsea aestivalis* (L.) Fernald, 1945). Sedges (*Carex* spp.) and sphagnum moss are also common. The dominant vertebrates are amphibians, although pygmy sunfish (*Elassoma* spp.) have also been collected (S. H. Bennett, pers. comm.).

Like many isolated wetland ponds on the Atlantic Coastal Plain of the southeastern United States, Savage Bay harbors a rich community of microcrustacean species. Nineteen species of Cladocera were observed, along with an undetermined number of harpacticoid copepods and ostracods. At least three cyclopoid copepod species have been collected here: *Macrocyclops fuscus* Jurine, 1820, *Tropocyclops extensus* Kiefer, 1931, and *T. prasinus mexicanus* Kiefer, 1938. No Anostraca or Conchostraca have been observed in Savage Bay.

Discussion and comparisons.—Female *A. savagei* might be confused with two other congeners: *A. forbesi* Light, 1938, and *A. lintoni* Forbes, 1893. The morphological differences lie primarily in the length and armament of the antennules and relative length of leg 5, exopod, and geographic range (Table 1). Furthermore, *A. lintoni* is substantially larger than the other two species. Besides the obvious size difference in size between *A. savagei* and *A. lintoni*, there is also a difference in color. Live or freshly-preserved *A. savagei* are pale blue with the distal ⅓ of the antennae being colored orange-red, although the pigments may fade after preservation. *Aglaodiaptomus lintoni* are completely red (Marsh 1907).

The male *A. savagei* might be confused with *A. spatulocrenatus*. There are obvious differences between females of the two species. The males are distinguished by the fifth leg (Table 2).

Three of the six diaptomids described from the United States and Canada since Wilson published her key (1959) belong to the genus *Aglaodiaptomus*. Four of the six species were collected from seasonal ponds, including all three *Aglaodiaptomus* and *Hesperodiaptomus californiensis* Scanlin and Reid, 1996. Carolina bays, vernal pools, and other seasonal wetland ponds in

Table 2.—Major morphological differences between male *Aglaodiaptomus savegei* and *A. spatulocrenatus*.

	A. savagei	*A. spatulocrenatus*
Leg 5, right, basis	Medial-posterior lobe only	Medial-posterior lobe and distomedial hook-like protrusion
Leg 5, left, endopod	Outer margin with scale-like protrusions	Outer margin scalloped
Leg 5, left, distal processes	Nearly equal in length	Inner twice as long as outer
Leg 5, left, exopod 2	As long as exopod 1	Half as long as exopod 1
Length	1.0–1.3 mm	1.1–1.3 mm
Geographic range	Eastern North and South Carolina	Quebec to east coast; south Atlantic coastal states to Maryland

North America have long been neglected as subjects for study. As more research ensues in poorly studied regions and habitats, it is likely that additional new species will be discovered.

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